Space Weather Technical Forecast

Issued on Friday 31 January 2025 at 12:28 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of isolated M-class flares. G1 minor geomagnetic storms likely 31 Jan due to onset of CH11 fast winds.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been moderate, with a single M-class flare recorded in the past 24 hours—an M1.0 from AR3976. Aside from this, only C-class flares have been observed.

There are currently eight sunspot regions visible on the Earth-facing side of the Sun, with seven numbered regions including recently numbered AR3980 and AR3981, and one new simple region which has recently emerged approaching the northwest limb. AR3976, AR3977 and AR3978 are close to each other in the northeast with entwined magnetic complexity. They continue to represent the bulk of current solar activity, with some ongoing growth evident, especially within AR3976 which is now classified as Dai/beta-gamma-delta having developed a delta spot within its northernmost spot. The remainder of the spots or small or comparatively magnetically simple.

No earthbound CMEs were observed in the past 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind speed, as measured by ACE at L1, remained at background levels throughout, ranging from 280-370 km/s. Density was below average to average. The Interplanetary Magnetic Field, Bt, increased from weak levels to become moderate and temporarily strong, peaking at 16nT at 30/2206 UTC. The north-south component, Bz, was largely positive, but became weakly negative from around 31/0800UTC. Phi angle was predominately positive. Geomagnetic activity was mainly quiet (Kp 0-2) with a single Unsettled (Kp 3) period 30/2100-0000 UTC.

Energetic Particles / Solar Radiation: High energy proton flux at GOES18 was at background. High energy electron flux (greater than 2MeV) at GOES16 was at Background. The associated 24-hour fluence persisted below the Active threshold, recording 1.54e6 integrated pfu at 31/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate expected, with a chance of isolated M-class flares, primarily from the regions on the northeast disc.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs currently expected, with the outlook dominated by the large recurrent coronal hole, CH11/+, in the north centre disk. The

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onset of a significant high speed stream (HSS) from CH11 is most likely today (31 Jan). Quiet to Unsettled activity (Kp 2-3) is expected initially, but increasing to give a likelihood of Active to G1/Minor Storms (Kp 4-5), and a slight chance of G2/Moderate Storms (Kp 6) through today and tomorrow (31st and 1st). Through days 3 and 4 (2nd and 3rd) activity is expected to gradually decline to Quiet to Unsettled (Kp 2-3) levels.

Energetic Particles / Solar Radiation: GOES18 high energy proton flux is expected to be at background. GOES16 high energy electron flux is expected to show a rising trend later in the period. The flux may temporarily reaching High levels, at the peak of the diurnal cycles, from day 3 (02 Feb). The corresponding 24-hour fluence is expected to remain below the Active threshold, but with an increasing trend.

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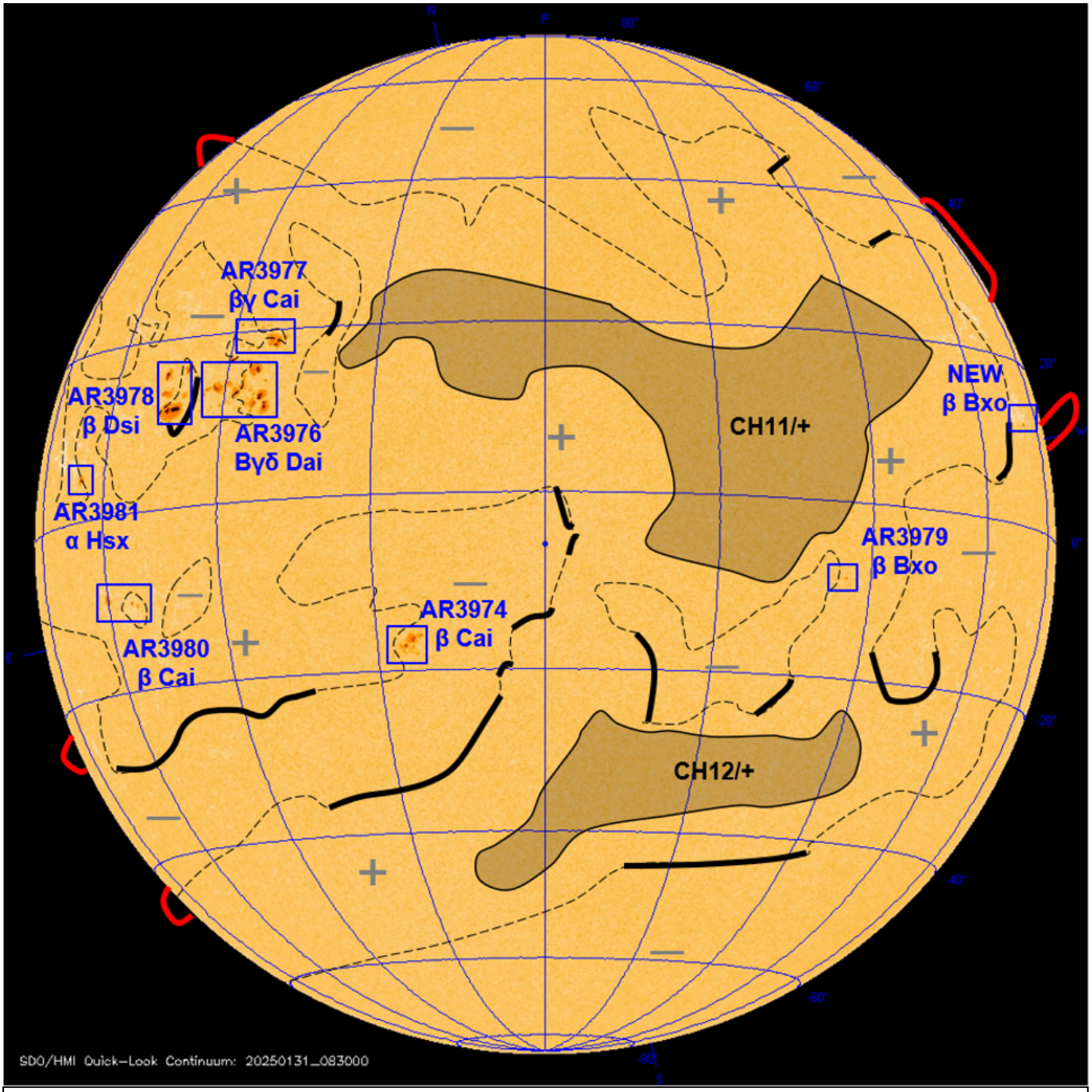
Figure 1: Synoptic Map valid 31/0830 UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

Currently no Earth-directed CMEs feature in the forecast.

The current forecast is dominated by the large recurrent coronal hole, CH11/+, near centre disk. This feature is expected to bring an increase of solar winds from current background levels to eventually elevated or strong levels, 550-650km/s. This increase is likely to occur in stages over a few days, probably starting today (31st). This is supported from both recurrence and MOSWOC ENLIL model output, although MOSWOC ENLIL has been too early bringing in the HSS. Solar wind speeds are then expected to gradually decline later in the period, perhaps falling to slightly elevated levels during day 4 (3rd Feb).

Quiet to Unsettled activity (Kp 2-3) is expected initially, but increasing to give a likelihood of Active to G1/Minor Storms (Kp 4-5), and a slight chance of G2/Moderate Storms (Kp 6) through today and tomorrow (31st and 1st). Through days 3 and 4 (2nd and 3rd) activity is expected to gradually decline to Quiet to Unsettled (Kp 2-3) levels.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	**G1 to G2**	No	60	50	20	10
Strong	**G3**	No	1	1	1	0
Severe	**G4**	No	1	1	1	0
Extreme	**G5**	No	1	1	1	0

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Figure 2: Latest MOSWOC Enlil model

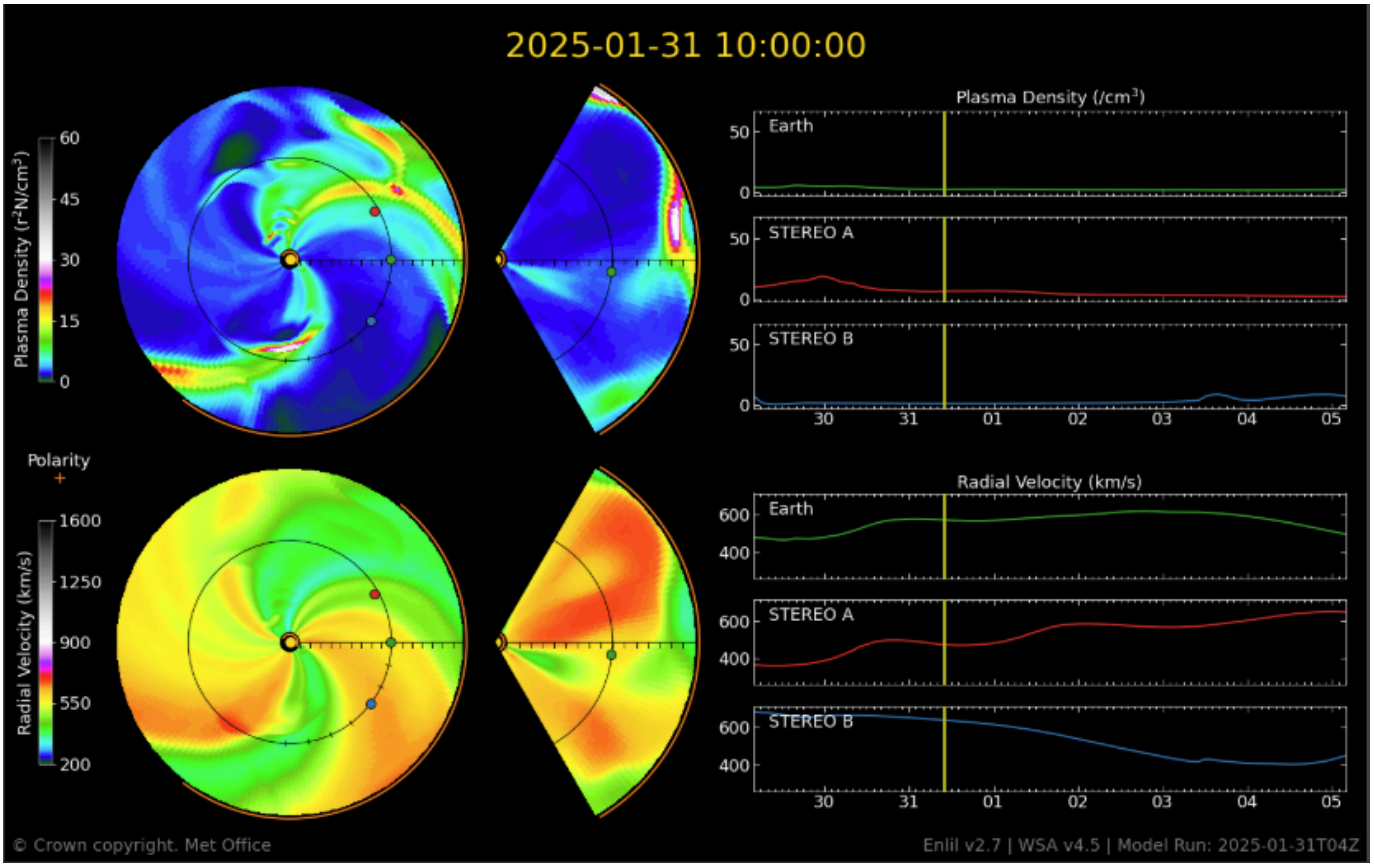
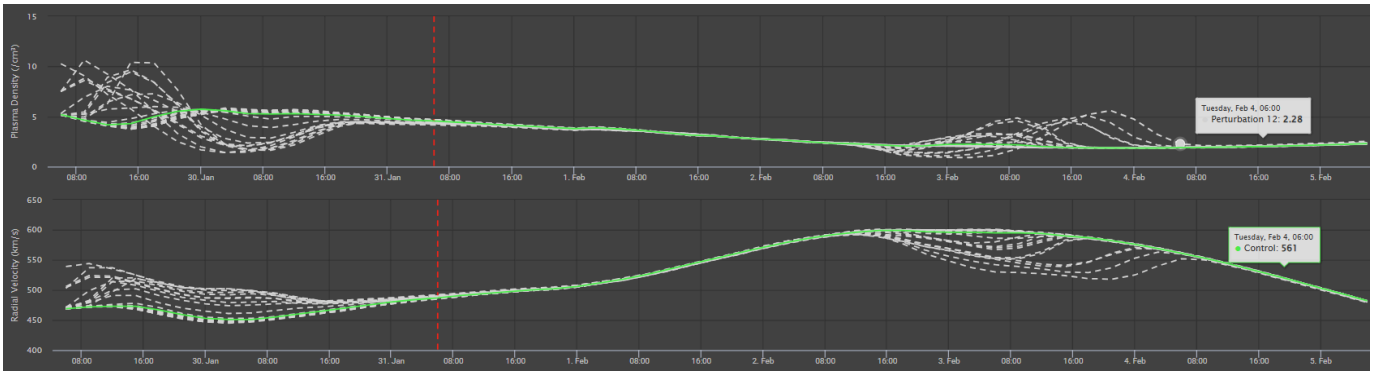


Figure 3: Latest MOSWOC Enlil Ensemble



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Radio Blackouts - X-Ray Flares

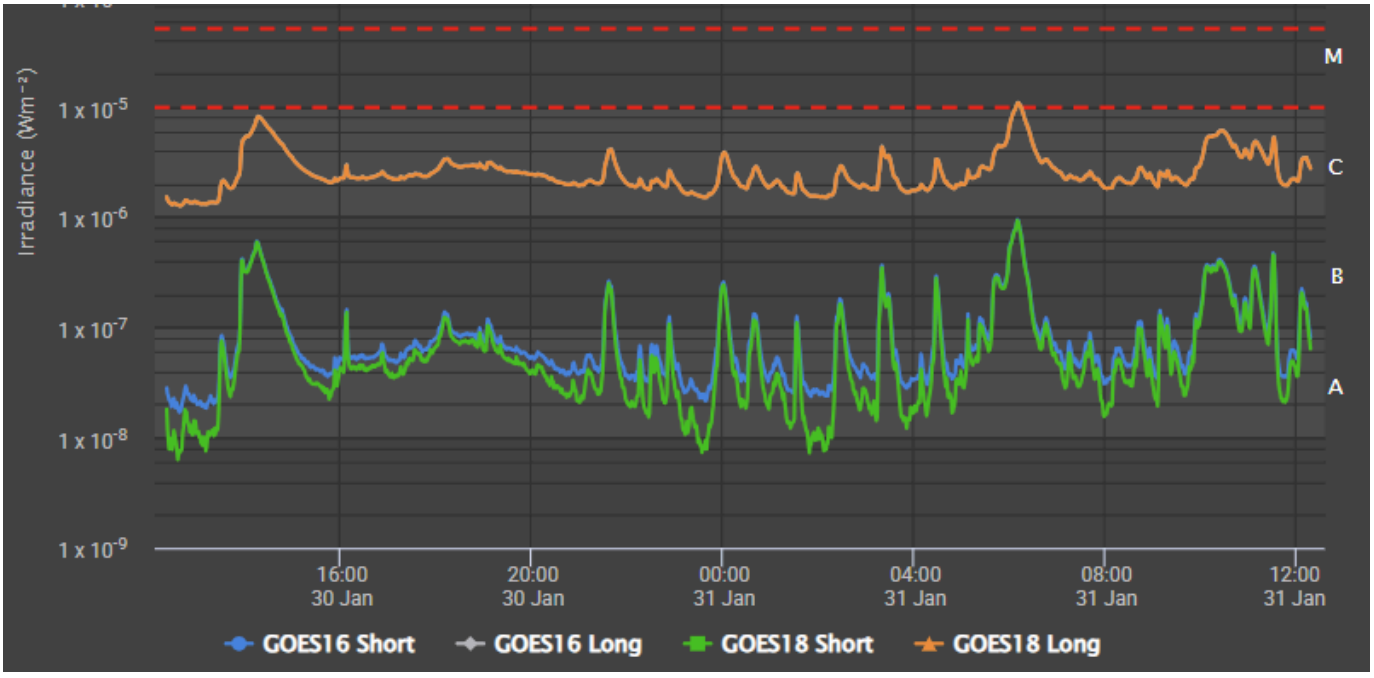
Solar activity has been moderate, with a single M-class flare recorded in the past 24 hours—an M1.0 from AR3976. Aside from this, only C-class flares have been observed.

There are currently eight sunspot regions visible on the Earth-facing side of the Sun, with seven numbered regions including recently numbered AR3980 and AR3981, and one new simple region which has recently emerged approaching the northwest limb. AR3976, AR3977 and AR3978 are close to each other in the northeast with entwined magnetic complexity. They continue to represent the bulk of current solar activity, with some ongoing growth evident, especially within AR3976 which is now classified as Dai/beta-gamma-delta having developed a delta spot within its northernmost spot.

Low to moderate solar activity is expected to continue, with a chance of isolated M-class flares, primarily from the regions in the northeast of the solar disc.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	No	50	50	50	50
Very Active	R3-R5 (X Class)	No	5	5	5	5

Figure 4: Past 24 hour GOES x-ray flux.



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Solar Radiation Storms (High Energy Protons)

Proton flux as observed by GOES-18 is currently at background and with the majority of the current solar activity on the northeast disc.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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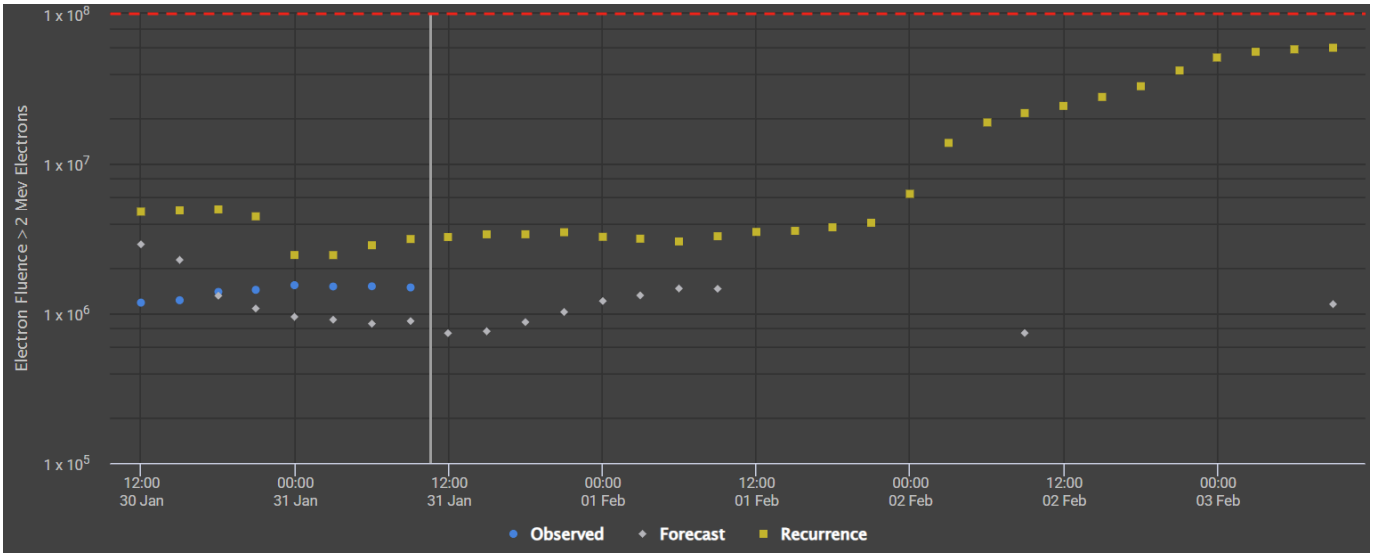
High Energy Electrons (≥ 2MeV)

High energy electron flux observed at GOES16 has been at background and expected to persist at similar levels today and tomorrow (31 Jan-01 Feb). A rising trend is then likely, due to the charging of the Van Allen Belts from the arrival of CH11/+ fast winds. This could bring Moderate, with a chance of High flux, by the end of the period.

The corresponding 24-hour fluence is expected to remain below the Active threshold and therefore MOSWOC REFM is felt to be giving good guidance. However, a rising trend is preferred expected by day 3 (02 Feb).

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	1	1	10	20
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

Figure 5: Latest MOSWOC REFM model.



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